

# High Performance Components

## Highly Loaded Compressor Blades

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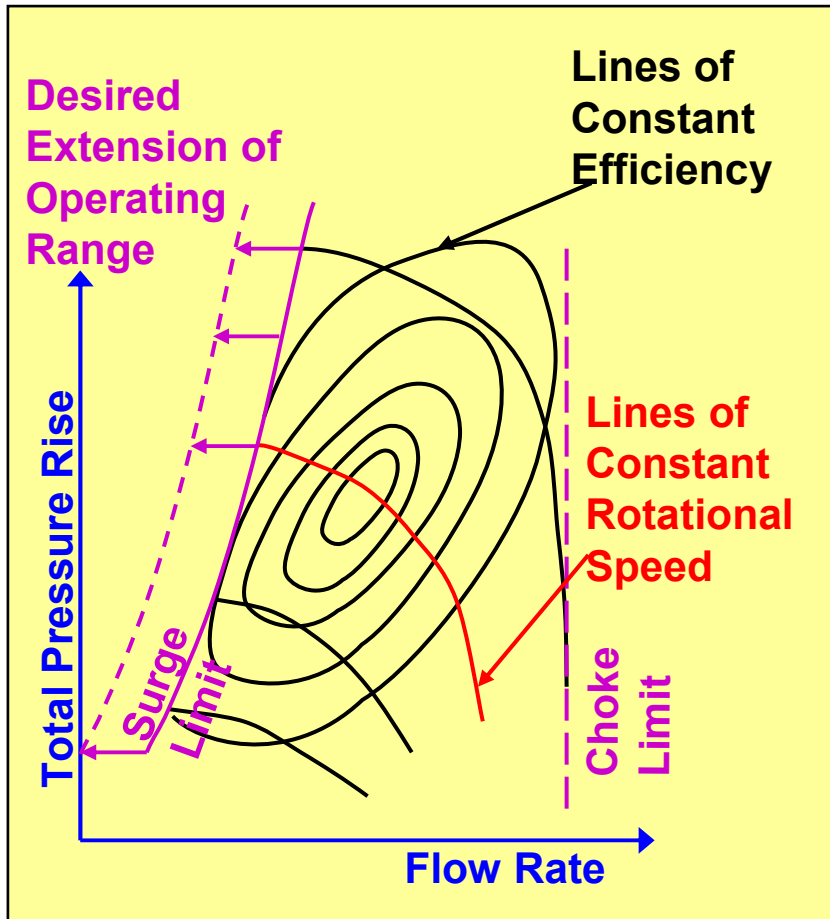
**Collaborators: Drs. Prasad, Dunn, and Neumier**

**Task Duration: 2 years**

**Presentation made by Dr. Krish Ahuja**

# Motivation and Objectives

- Next generation compression systems will have high pressure rise per stage, and will operate closer to stall line than existing systems.
- Active and passive control strategies needed to achieve this loading, without experiencing rotating stall, surge, and other instabilities.



- Use CFD to explore and understand compressor stall and surge
- Develop and test passive (slotted airfoils) and active control strategies (circulation-controlled stator vanes) for centrifugal and axial compressors
- Compare with measurements, where available
- Develop and test control laws jointly with collaborators

# Relevance

- High pressure ratios are important for reducing the number of stages in an engine, with attendant reductions in engine weight and size.
- Conventional approaches for engine control rely on inter-stage bleeding, which reduces the efficiency of the system.
- Research on efficient ways of controlling instabilities is needed for ensuring the safe operation of these systems

# Approach

- Select configuration and operating conditions



- Construct the performance map of representative axial compressor configurations
- Use a 3-D compressible Navier-Stokes solver developed by the present investigators



## Passive

- Investigate leading edge and trailing edge stall alleviation
- Use slotted airfoils for these configurations.
- Performance penalties at off-design conditions will be assessed.



## Active

- Use trailing edge Coanda jets from the stator vanes as a means of achieving radial variations of the incident flow angles.

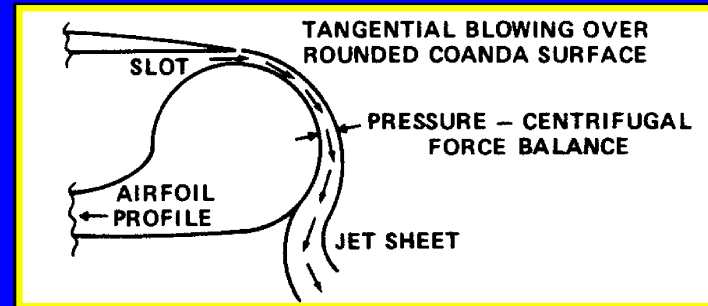
# Chances of Success

## Passive

- Considerable experimental evidence available on the effectiveness of passive blowing via slots and openings
  - Blown Flap
  - Ejectors
- This work fine-tunes the configuration via CFD before Conducting expensive experiments
- Chances of Success: High

## Active

- Considerable collective experience at Georgia Tech on Coanda Blowing
- A number of NASA contracts



- Chances of Success: High